

Claims

We Claim:

- 5 1. A chemical-library composition comprising
- Sub B1
- 10 (c) a plurality of coded carriers, each having $N > 1$ spatial code positions and one of $M > 2$ optically detectable indicia at each code position, so that each carrier can be optically identified by one of up to M^N different code combinations, each of said $M > 2$ indicia being a different color, and
- 15 (d) a different known chemical compound carried on each different combination carrier.
2. The composition of claim 1, wherein each of said carriers is formed of N separate layers or bundled fibers, each layer or bundled fiber having one of M different color indicia, wherein said layers or bundled fibers form said spatial code positions.
- 20 3. The composition of claim 2, wherein each carrier is a cylinder of stacked layers, where the cylinder diameters are in the 1 to 200 micron range.
- Sub B2
- 25 4. The composition of claim 1, wherein each of said carriers has a magnetic layer or component that allows for magnetic separation and orientation of said carriers.
- 30 5. The composition of claim 1, wherein the different compounds in the composition are selected from the group consisting of oligonucleotides, nucleic acids, DNA, cDNA, or viral DNA, having one or more known identifiable characteristics.

Sub B3
6. The composition of claim 1, wherein the different compounds in the composition are peptides, oligopeptides, proteins, having one or more known identifiable characteristics.

5 7. (Amended) The composition of claim 1, wherein the different compounds in the composition are compounds having one or more known identifiable.

8. A method of forming a library of determinable chemical compounds, comprising the steps of

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- (a) placing into each of a plurality of a separate reaction vessels, carriers having a selected one of a plurality of optically detectable code combinations, each defined by one of $N > 1$ spatial code positions and one of $M > 2$ optically detectable indicia at each spatial code position, such that the carriers in any vessel all have one of up to M^N different code combinations,
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- (b) reacting the carriers in each vessel with reagents effective to form on the carriers, as solid-supports, a selected one of up to M^N different known library compounds, and
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- (c) forming a mixture of carriers from different reaction vessels.

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9. The method of claim 8, wherein said reacting includes the steps in a stepwise oligomer synthesis reaction effective to form oligomers with known or random sequences on the solid-support carriers.

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10. A method of detecting one or more target molecules capable of binding specifically to one or more different, known library compounds, comprising

(a) contacting the target molecule(s) with a chemical-library composition composed of

(i) a plurality of coded carriers, each having $N > 1$ spatial code positions and one of $M > 2$ optically detectable indicia at each code position, such that each carrier can be identified by one of up to M^N different code combinations, and

(ii) a different known library compound carried on each different-combination carrier, under conditions in which the target molecules can bind specifically to known library compounds,

(b) distributing the carriers for individual-carrier decoding, and

(c) detecting carriers having bound target molecule(s) and

(d) decoding the carriers having bound target molecules, to identify the library compound(s) to which the target molecule(s) are bound.

11. The method of claim 10, wherein said distributing includes placing the carriers at discrete locations on a substrate surface, and said detecting and decoding is carried out by an optical detector operable to optically scan the substrate surface.

12. The method of claim 10, wherein said distributing includes flowing said cylinders through a capillary tube, past a detector.

13. The method of claim 10, wherein said distributing includes aligning said carriers in a capillary tube, and moving said tube relative to an optical detector.

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14. A method of multiplexing the detection and quantification of analytes comprising the steps of:

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- (a) distributing on a surface a plurality of said coded carriers of claim 1, said carriers each different carrier having a different compound attached thereto,
 - (b) scanning the surface for carriers having a detectable reporter,
 - (c) recording the positions of the carriers having a detectable reporter,
 - (d) determining the code for each carrier at each recorded position.

15. An array device comprising,

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- (a) a surface, and
 - (b) a plurality of spatially coded carriers having different compounds attached to different carriers, wherein the carriers have $N > 1$ spatial code positions and $M > 2$ optically coding indicia at each spatial coding position, each of said optical coding indicia being a different color, said carriers are randomly distributed upon the surface.
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16. A kit comprising

30 a plurality of separated classes of compoundless coded carriers,

wherein each class contains a plurality of compoundless coded carriers,

- (a) each carrier within that class having the same spatial code, said spatial code having $N > 1$ spatial coding positions and $M > 2$ optical indicia at each coding position, each optical indicia being a different color, and each different class having compoundless coded carriers having a different code, and
- (b) each compoundless coded carrier is capable of having a compound attached thereto.

17. A method for making the composition of claim 1, comprising the steps of forming thin transverse section of an assembly comprising $N > 1$ filament regions of $M > 2$ different colors by bundling together said filaments to form a fused bundle, and sectioning said fused bundle to produce carriers having one of said $M > 2$ color indicia at each of said $N > 1$ spatial code positions, and attaching to each of said carriers a different known chemical compound.

18. The composition of claim 1, wherein at least one of said $M > 2$ indicia is a nanocrystal having a different color spectral output from said other indicia.

19. A method of detecting two or more target molecules in an analyte capable of binding specifically to two or more known different compounds on different carriers from a carrier library contained in an sample, comprising the steps of

- (a) partitioning the carrier library into a plurality of sublibraries and splitting the analyte into a plurality of subanalytes,
- (b) contacting each subanalyte with a sublibrary in a condition in where at least one target molecule can bind

specifically to at least one corresponding sublibrary carrier and where conditions are independent for each sublibraries,

(c) pooling together carriers from all sublibraries,

(d) distributing the carriers on a surface,

(e) detecting carriers having bound target molecule(s) and

(f) decoding the carriers having bound target molecules, to identify each compound that bound target molecules are bound.

20. The composition of claim 2 wherein at least two of said layers or bundled fibers is a fused glass fibers.

21. A coded particle for use in carrying out selected chemical or biological reactions or analyses, comprising

(e) a plurality of self-orienting coded carriers, each having $N > 1$ spatial code compartments and one of $M > 2$ optically detectable indicia at each code compartment, so that each carrier can be optically identified by one of up to M^N different code combinations, each of said $M > 2$ indicia being a different color, and

(f) a different known chemical compound carried on each different-combination carrier,

wherein each of said carriers is formed of N separate layers or bundled fibers, each layer or bundled fiber having one of M different color indicia, said layers or bundled fibers form said spatial code compartments, and said carrier are formed in a shape adapted to self orient

into a carrier holder within an holder array to expose said spatial code to a optical window within said holder, said window in optical communication with a detector for reading said spatial code.

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22. The coded particle of claim 21 wherein the carrier has a cross sectional shape selected from the group consisting of; circles, triangles, squares, hexagons, octagons, decagons, polygons.

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23. The coded particle of claim 21 wherein at least one carrier is embedded in a larger spherical structure, wherein said code is readable from an external surface of said spherical structure, said structure is adapted to hold compounds, cells, or biological materials.

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24. The coded particles of claim 21 wherein said carrier is self orientating by virtue of a portion of said carrier being susceptible to attraction or repulsion by a force selected from the group consisting of gravity, electrostatic forces, electrophoretic forces, dielectric forces, and magnetism.

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25. An apparatus for detecting activity on the coded carrier of claim 21, and determining said code, comprising,

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a carrier holder array, said carrier having a plurality of holders distributed therein, said holders adapted to hold said carriers so that said coded carriers code faces an optical window in optical communication with a detector, said window situated within said holder to optically detect at least one surface of said carrier, said at least one surface displaying said spatial code,

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wherein when said carrier is held in said holder after said carrier is positioned within said holder, said detector is able to detect at least one activity on said carrier, and said detector is able to detect said spatial code of said carrier.

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26. The apparatus of claim 25, wherein said carrier is self-orienting, and said holder is adapted to self-orient said carrier so that at least one spatial code is detectable by said detector.

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27. A composition for multiplexed analysis of one or more different known cell populations comprising:

a plurality of coded carriers, each formed of $N > 1$ ordered spatially distinct compartments, and each compartment having one of $M > 1$ detectable indicia, such that each carrier can be identified by one of up to M^N different code combinations, and
a different known cell population attached to each different carrier.

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28. A composition for multiplexed analysis of one or more different known cell populations comprising:

a plurality of coded carriers, each formed of $N > 1$ ordered spatially distinct compartments, and each compartment having one of $M > 2$ detectable indicia, such that each carrier can be identified by one of up to M^N different code combinations, and
a different known cell population attached to each different carrier.

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29. A microparticle for carrying and identifying one or more compounds or biological entities attached thereto, comprising:

a coded carrier,

said coded carrier having a spatial optical code formed therein, said code having $N > 1$ spatially distinct compartments, and each compartment having one of $M > 2$ spectrally distinct detectable indicia, such that each carrier can be identified by one of up to M^N different code combinations, and

one or more known compounds or biological entities attached to said carrier,

said compounds or biological entities having at least one identifying feature,

wherein said code correlates to said identifying feature of said compounds or biological entities, to identify such compounds or biological entities.

30. An apparatus for analyzing events occurring on or adjacent a microparticle containing an identifying code having at least one code viewing surface, comprising:

one or more fiber optic receivers,

said receivers having an outer cladding and an inner core, said outer cladding protruding at one end from said inner core to form at least one wall of a receiver area for receiving and orienting said microparticle so that at least one code viewing surface of said identifying code faces said end of said fiber optic receiver,

a detector

said detector for detecting said events occurring on or adjacent said coded microparticle, said detector being in optical communication with said inner core,

a reader,

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add by